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ABSTRACT

Two essays discuss the need for improved international transfer of scientific and technical information and propose the international language Esperanto for that purpose. "The Role of Esperanto" by Ouyang Wandao suggests that the burden of time and energy spent in translating scientific literature quickly and well and the difficulties of exchanging technical information among scientists around the world could be reduced considerably by using Esperanto as a neutral international medium of communication. "The Issue of Spoken Language" by Bruce A. Sherwood describes the problems faced by an English-speaker among scientists who do not understand spoken English well enough to understand his lectures on technical topics, and recommends that scientific societies encourage their memberships to use Esperanto, an easily learned, politically neutral auxiliary language that can be mastered in its spoken and written forms and can save scientists valuable time. (MSE)

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# THE LANGUAGE PROBLEM IN SCIENCE AND THE ROLE OF THE INTERNATIONAL LANGUAGE ESPERANTO

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# THE LANGUAGE PROBLEM IN SCIENCE AND THE ROLE OF THE INTERNATIONAL LANGUAGE ESPERANTO

## PREFACE

Over the past several years, the users and supporters of the International Language Esperanto have devoted more and more attention to the use of their language in science. Esperanto has frequently been shown to be a very suitable scientific language, because of its flexibility, its precision and its simplicity. Many scientific publications have appeared in Esperanto, and it has often been used in scientific conferences. At present, increasing attention is being devoted to the expansion and standardization of scientific terminology in Esperanto, because it is not enough for the language to be easy and flexible; it is also important that the right vocabulary be available to specialists.

In the present document, the reader will find two studies on the use of Esperanto in science. One was written by a Chinese scientist, so by one of those people who feel most strongly the need for an international means of scientific communication that can be easily mastered. The other is the work of a scientist from the United States, who feels the lack of easy and effective communication with those who do not speak English. Both authors come to the same conclusion: that the scientific world needs an effective and easy language of communication and that that language is the International Language Esperanto.

## THE ROLE OF ESPERANTO

**Ouyang Wendao**

In today's world extensive scientific and cultural exchanges are taking place between various countries. Because of the wonderful growth in the quantity of scientific literature, people have begun to notice the language problem in the sciences.

Some specialists have estimated that 60 % of the world's scientific literature in some fields has been published in English and 40 % in Russian, German, French, Japanese and other languages. If this is generally the case, and scientific and technical workers speak only one language, then a very great quantity of scientific literature in other languages cannot be quickly utilized. This is a very great loss for the development of our sciences. To solve this problem, many countries have had to found necessary institutions to translate and make available information and periodicals. Every year much human and material strength is consumed in such work; it has already become a great burden for the whole world. But it still does not conform to the progress of science and satisfy the need for scientific exchange among different countries, nor does it solve the linguistic difficulties faced by scientific workers in different countries.

Furthermore, every year throughout the world there occur hundreds of scientific conferences and special symposia and meetings which present good occasions to get to know about the latest scientific attainments and to exchange scientific viewpoints. But the language barrier greatly reduces the real results that should be reaped from such conferences.

The language problem in science even more urgently requires solution for Chinese scientific and technical workers. Today China is undertaking construction of the four modernizations, and for that our scientific and technical workers must learn many advanced sciences and the experience of other countries, and develop scientific and cultural exchanges with them. Because of the urgent need to realize the four modernizations, our scientific workers are now actively studying English, French, Japanese, German, Russian and

other foreign languages. Because Chinese is very different from the European languages, the difficulty of learning those languages can be imagined. Chinese scientific and technical workers have to spend much time out of their entire lives to learn foreign languages. Usually they learn one foreign language for 5-6 years in high school and then 1-2 years in university. And many of them continue such learning during working and after-work hours. But only a few of them can easily read scientific literature in 1-2 foreign languages and even fewer can translate and write in them, or freely talk with foreigners. That presents a great hindrance to our country in wider scientific exchange with other countries.

Exactly as shown by the Second International Conference on Language Problems in Science, the language barrier hinders international scientific exchange. For scientific workers in different countries, seeking an effective method of overcoming that language barrier in the sciences has become an urgent need.

An ideal solution to that problem might be a neutral international language, belonging to no country or nationality and acceptable to the majority of countries and peoples. It should be easily understandable and learnable, have a rigorous scientific capability, be logical and elastic, and be able to fully express mankind's common thoughts and to be used for scientific and cultural exchanges. Furthermore, it could be used as a model for language teaching and a bridge for learning national languages. It would make learning of national languages much easier.

What language might serve as such an international language? In my opinion, Esperanto is the most suitable.

Since Zamenhof created Esperanto, it has lived through 100 years of trial and practical use, and is recognized by the whole world as a living international language. Because it is neutral, it causes no language discrimination against any nation. It is easily understandable, has a high scientific capability and rich expressions. Its wide popularity is shown by the fact that peoples of various countries can freely develop it in its use, and there are international and national organizations which exist especially to promote it. All those who have no prejudices against Esperanto and who do not persist in the established interest of the languages of the great nations, can see that increasing the use of Esperanto throughout the world,

especially in science, will bring mankind great utility. Already some scientific workers and specialists have published their research attainments in Esperanto or carried out scientific and technical exchanges in it, and have gained a certain measure of success. For instance: in December 1982 the proceedings of *Interkomputo*, the international computer science conference in Budapest — carried out in Esperanto — were published. They came to six volumes of material. This proves that Esperanto can truly play a role as international language.

Researching computer translation of Han-language informatics, I have found that Esperanto can be an ideal interlanguage in computer translation of scientific literature. The idea of machine translation through an interlanguage was suggested long ago. But some people have tried to create a completely new sign language to play that role. That idea may not be realistic, because the languages of mankind are so rich that they cannot be expressed simply through signs. In my opinion, there is no other language more suitable than Esperanto to play this role of interlanguage in the translation of national languages. Because of its scientific capabilities, logical basis and regularity, Esperanto may be the most suitable to be handled in a computer and used for comparative analysis and mechanical exchange with different national languages.* If we want to translate a Chinese text into other languages with Esperanto as an interlanguage, we must first translate our Chinese text into Esperanto and then from Esperanto into other languages. Similarly, foreign-language texts can be translated into Chinese through Esperanto. In this way, only one language must be used, Esperanto, both into and out of Chinese. This not only makes possible quick translation of a large quantity of scientific literature and acceleration of scientific and cultural exchanges between different countries, but can also save much human and material energy. That is why Esperanto will make possible an earlier realization of the translation of scientific literature by computer. This is what I, a scientist and Esperantist, believe. I hope that my belief conforms to reality. Of course, realization of all this depends on the cooperation of scientists and Esperantists in different countries. We in China can, in particular, carry out research on translation between Esperanto and our own national language.

A number of countries have carried out many experiments that prove that learning Esperanto first, other Western national languages afterwards, not only does not hinder the learning of the latter but, just the opposite, helps it. For us Chinese, learning Esperanto is much easier than learning other Western languages because Esperanto has, besides its own superior points, many similarities with Chinese. This is why learning Esperanto first, other foreign languages afterwards, is a short cut for the Chinese in their learning of foreign languages. This is probably even more true for Europeans.

From my arguments you can see that Esperanto will be an ideal international language in scientific and cultural exchanges; it has the capability of being an interlanguage in scientific experiments on computer translation; it is a bridge to learning other languages in the language-teaching of various countries. All this offers a great perspective for Esperanto in science. Of course, there is still much research to be done in this field

We are full of confidence in the future. With the progress of human culture and the development of sciences, an international language will become ever more urgently needed, and the need for a solution to the language problem in science through Esperanto will be recognized by an ever greater number of people. We will certainly see that today's ideal will be tomorrow's reality.

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* The Dutch *Buro voor Systeemontwikkeling* and the Danish firm *Christian Rovsing*, under contract to the EEC, are currently studying the possibility of using Esperanto as a computer-translation bridge language in international videotext transmissions. [*The translator*]

## THE ISSUE OF SPOKEN LANGUAGE

**Bruce A. Sherwood**

Most scientists in the world have been compelled to learn to *read* English, and most have succeeded. Because of this, scientists tend to assume that the spread of English has solved the language problem in science. But there are enormous problems associated with *spoken* English. While I was at a particle-physics summer school in Erice, Sicily, my knowledge of Italian encouraged me to spend a lot of time with young Italian scientists, who admitted that they couldn't really follow the English-language lectures. After giving a talk in English at the University of Ulm, West Germany, I was disappointed to learn that many of the science students had had difficulty following my presentation even though I had been careful to speak distinctly and to avoid slang. At a week-long seminar in Moscow involving scientists, engineers and university educators, all talks had to undergo the slowness and indirectness of serial translation, and personal discussions during tea breaks were impossible due to the highly limited English of most of the Russians and the highly limited Russian of most of the Americans, myself included. (It is probably true that all the Russians could *read* English adequately.) Despite enormous efforts by the Japanese, including eight to ten years of school study, most of the many Japanese scientists who visit my laboratory are barely able to speak quite inadequate English, and understand very little of what is said to them. A nuclear physicist of my acquaintance sparkles with lively intelligence in Spanish but is reduced to frustrated inarticulateness in English despite strenuous efforts to learn to speak it (she *reads* English fluently.) She must appear much less impressive to my American colleagues than she has appeared to me. These real problems are hidden from many American scientists by the fact that the foreign scientists whom they hear speaking adequate English at international conferences are a ***highly biased sample***. Success in international science is now conditioned by a discriminatory, non-scientific factor: the ability to speak English. Sometimes American scientists complain that they have difficulty finding the time to learn merely to read other languages, but at least they aren't compelled to do this (for the most part, U.S. uni-

versities no longer require their science students to learn foreign languages). Foreign scientists are not only compelled to learn to read English: if they aspire to the heights of international science they must find some way to learn spoken English. The lucky few find some way to study or work in an English-speaking country. While this discriminatory burden is unfair to all foreign scientists, as with all discriminatory burdens it falls most heavily on the weak, including young scientists in the Third World (except perhaps in former British colonies). It may not be especially difficult to read English, but many foreigners find it extremely difficult to learn to speak and understand English. The complex sounds and confusing spelling mean that a reading knowledge contributes little to speaking and understanding. In the past, many good students of science in the United States never succeeded in passing an examination in German; in the same way, there must exist many competent foreign scientists who will never learn to speak or understand English, however hard they try. These invisible victims will never fully participate in the world of international science.

Precisely because they are hidden, it is difficult to obtain any reasonable measurement of how many scientists are "invisible victims" because of their inability to speak English. However, Paul Neergaard, of Denmark, has discovered a brilliant way of acquiring some partial data. Some years ago, he did a statistical study of the diffusion, through experimental stations and university courses, of the science and technology of seed pathology as these were developed in his laboratory. He found that this diffusion was heavily dependent on linguistic factors. For example, the techniques in question spread more extensively in the English-speaking countries of Africa than in the French-speaking countries. In the same way, he showed statistically that students from countries using English came to his laboratory in greater numbers than did students from countries using French. We need more studies of this kind for a better understanding of the extent of this problem of discrimination.

It is quite difficult for a foreigner to *write* good English for scientific journals. I certainly could not write acceptable scientific prose in Spanish or Italian, even though I have given adequate lectures in these languages. Authors must often ask a friend for help or even hire a translator to prepare an English-language paper. Clearly, such

requirements weigh more heavily on younger and more isolated scientists. The new custom of requiring camera-ready manuscripts for conference proceedings means that unedited contributions are increasingly poor because of their author's inability to write English.

In summary, English is viable where only passive reading is concerned but is not an appropriate vehicle for speaking, understanding, and writing in international science. It is time for scientific societies to consider encouraging the use of an easily learned, politically neutral auxiliary language for international use, which busy scientists could master in both spoken and written form. Such a language would allow all scientists to participate in science on an equal basis, without the need to invest large quantities of valuable time.

Fortunately, such a language already exists: Esperanto. A young Japanese scientist, who speaks excellent Esperanto and reasonable English, recently told me that in his estimation Esperanto is five or six times easier to master than English. Having studied Esperanto, Italian, French, Spanish, Russian and Persian, I would maintain that an American gains a command of Esperanto three to five times more easily than other languages. To give a specific example, I studied Italian formally for a year and later studied for a year in Italy, but I learned Esperanto in a few months of self-study with a simple textbook. None the less, I can read, write, speak and understand Esperanto with greater power, confidence and precision than Italian. I have given scientific lectures in Esperanto with better audience understanding and participation than I obtained at my English, Spanish and Italian lectures in foreign countries.

The sounds of Esperanto are far simpler than those of English and they resemble the sounds of Spanish. For example, the five Esperanto vowels are easily distinguished from one another, but the many English vowel sounds are barely distinguishable for many foreigners. Minor errors of pronunciation or of listening capabilty do not destroy the comprehensibility of an Esperanto vowel, but minor changes of English vowel sounds can change the meaning of a word entirely. Speakers of Spanish encounter great difficulty when they try to utter or hear the distinction between the English words "meet" and "mitt". Each Esperanto syllable is pronounced fully and clearly, without swallowing or reducing unaccented syllables as we do in English. Spelling is completely regular. Grammar is simple

and regular, without exceptions: verbs are not conjugated, plurals are regular, and nouns do not have grammatical gender. A flexible system of prefixes and suffixes contributes to the power and expressiveness of the language. For the most part, the vocabulary is based on Latin and Germanic roots, which occur widely in many languages. While the European quality of the vocabulary certainly makes Esperanto somewhat more difficult for Japanese than for Americans, on any absolute scale Japanese find it quite easy (and certainly easier than English). Furthermore, borrowings of European roots in Japanese, especially in science and technology, mean that the vocabulary of Esperanto is not totally foreign to native Japanese speakers. The same is essentially true for other non-European peoples and languages.

Even if we can agree that a problem exists and that Esperanto could solve it, there are those who would maintain that such a solution is utopian and unattainable. However, only relatively modest steps are needed to ensure steady progress. It should be emphasized that Esperanto was not designed to serve as a "universal" language that would supplant existing languages. On the contrary, Esperanto is intended as an auxiliary language for use among people whose native languages are different. Hence it can be useful even if it is applied only in a limited field, such as international scientific relations. A practical first step might be to have national and international scientific societies encourage the introduction of compulsory language study as one of the requirements for the doctorate, in the form of an examination in the reading and writing of Esperanto. Such a task should be relatively easy for a graduate student of science. Such are the extraordinary properties of Esperanto that an ability to read and write the language brings the student very close to an ability to speak it and understand spoken Esperanto. The first generation of doctoral students could teach themselves by means of available textbooks. This should be no great threat for an older scientists, since, unlike the situation with other languages, we could also acquire a reasonable knowledge of Esperanto in a relatively short time.

Potentially, there are great possibilities in the scientific world for an initiative of this kind. Interest in Esperanto is increasing in scientific and other circles in Europe, in part because of the growing burden of an increasing number of working languages in the European community. The Third World would find that a transition to Esperanto for international relations would greatly simplify many of its educational problems. Perhaps the greatest obstacles are a lack of awareness of the problem and its possible solution, a defeatist belief that nothing can be done, and the natural human desire of English-speaking elites, whether in English-speaking or non English-speaking countries, to maintain their privileged positions.

The history of the metric system will perhaps help scientists to understand why Esperanto has so far had so little effect that many scientists have never even heard of it. The metric system was first proposed in 1670. It was adopted in 1799 but it did not achieve general use in France until 1840. In spite of the great strength and prestige of France, and in spite of all its obvious advantages, the metric system became standard for Europe only in the final years of the nineteenth century. It may take until 1980 or later for the metric system to become generally accepted in the United States.

Esperanto was introduced in 1887 by Ludvik Zamenhof, of Poland. The Tsarist censor, two world wars and persecution by Hitler and Stalin almost destroyed Esperanto. While its political neutrality is a great advantage, a great disadvantage for Esperanto is the fact that it lacks the patronage of a powerful nation state in the way that the metric system enjoyed the patronage of France. Renewed interest in Esperanto is due in part to the insistent demands of more and more national languages for the rank of working languages in international organizations (Arabic, for example, is one of the recent arrivals). This situation of growing equality among languages is leading to linguistic chaos, which can be cured only through a single politically neutral auxiliary language.

In the United States we have engaged for years in an unending and fruitless debate on the value of compulsory language study for students of science. This lifeless, repetitive discussion is a symptom of the enduring failure of U.S. education to come up with a reasonable language policy. A new strategy is needed to escape from this blind alley. The old language requirements involved a great amount of work for meagre results and was perceived by most graduate students as arbitrary and capricious. This bred resentment and cynicism and led to the abandonment of compulsory language study in

the United States. We should have a language requirement, but we should make the work no longer burdensome, make the results real, and replace cynicism with idealism and an international spirit.

*OUYANG WENDAO is on the staff of the Automation Institute of the Chinese Academy of Sciences. His study, which was translated for this edition by David Jordan, first appeared in the Esperanto magazine «El Popola Ĉinio».*

*BRUCE A. SHERWOOD is Professor of Physics and specialist in educational computing at Carnegie-Mellon University, Pittsburgh, U.S.A. His study is based on a lecture given in Esperanto in 1979 at the Second International Conference on Language Problems in Science, Marilia, Brazil.*

**Publication list of Esperanto Documents**

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